## REMARKS

The present response is intended to be fully responsive to all points of objection and/or rejection raised by the Examiner and is believed to place the application in condition for allowance. Applicants assert that the present invention is new, non-obvious and useful. Prompt consideration and allowance of the claims is respectfully requested.

### Status of Claims

Claims 5-7 are pending. Claims 5-7 have been rejected.

Claim 5 has been amended herein. Applicant respectfully asserts that the amendments to the claims add no new subject matter.

Claim 7 has been canceled without prejudice or disclaimer. In making this cancellation without prejudice, Applicants reserve all rights in these claims to file divisional and/or continuation patent applications.

## CLAIM REJECTIONS

### 35 U.S.C. § 103 Rejections

In the Office Action, the Examiner rejected claims 5-7 under 35 U.S.C. § 103(a), as being unpatentable over Barkley (U.S. Patent No. 2,676,114) in view of Okamoto et al. (U.S. Patent No. 3,520,716). Applicants respectfully traverse this rejection.

Before discussing the rejections raised by the Examiner, Applicants provide a brief summary of the present invention as now claimed, and the advantages associated therewith. The present invention is a vapor deposition method for depositing mixtures of two or more different materials on a substrate, which method offers a number of significant advantages when compared to prior art processes, such as those described in Barkley and Okamoto.

The particular utility of the method of the present invention lies in the fact that the deposition gradient of each different material can be controlled independently, so that mixtures of any desired range of compositions can be produced. Thus, in an especially useful embodiment, the method can be used to deposit mixtures whose composition varies according to the position on the substrate, and those mixtures can then be analyzed to identify

an optimum composition for a particular purpose. Uniquely, the present invention then allows the user to repeat the method and to "zoom in" on the identified optimum composition, and to thereby identify the optimum composition more precisely. For each experiment, full use can be made of the entire surface of the substrate, thereby optimizing the range of compositions that can be deposited on any given substrate.

In order to illustrate the above, Applicants refer to a simplified example, in which mixtures of material A and material B are produced along one dimension of a substrate. In a first experiment, a linear deposition gradient of material A could be produced along the full length of the substrate, beginning with no deposition of material A at one end of the substrate and ending with a maximum deposition of material A at the other end of the substrate. Similarly, a linear deposition gradient of material B could be produced in the opposite sense. Thus, one end of the substrate would be deposited with only material A, the other end would be deposited with only material B, and all mixtures between these two extremes would be produced along the length of the substrate. The mixtures could then be analyzed, and it may be found, for example, that a mixture containing 50% of material A and 50% of material B has the optimum properties. A further experiment could then be carried out "zoomed in" on this composition. For example, the composition along the length of the substrate could be varied from 45% material A / 55% material B at one end of the substrate to 55% material A / 45% material B at the other end. Analysis may then find that the optimum composition is 49% material A and 51% material B, for example. Further "zooming in" experiments could then be carried out to further optimize the composition if required, each of these experiments using the full surface of the substrate.

The above is a simplified example, but the method of the present invention finds particular utility in more complicated systems, such as ternary systems, for example. In that case, concentration gradients of each of the three materials can be created across two dimensions of a substrate surface to obtain a range of ternary compositions. The above-described "zooming in" can then be carried out to find an optimum composition.

The above advantages are only achievable as a result of the particular arrangement of sources, masks and substrate defined in the amended claims, as described in further detail below:

1. "***vaporizing a different material from... each of said vapor sources***": A different material is vaporized from each source, i.e., there is a separate source for each material;

2. "***each vapor source having a face...", "vaporizing... material from said face***": Each vapor source has a face from which the material is vaporized. In other words, the vapor sources are 2-dimensional sources, and are not point sources or 1-dimensional (band-like) sources;

3. "***there is a separate mask between each vapor source and said substrate***": Each vapor source has its own associated mask, i.e., there is a mask per source;

4. "***a second plane is defined by the center of the associated vapor source, the center of the substrate and an edge of the mask***": The shadowing effect of each mask is obtained by the intersection of an edge (i.e., a single edge) of the mask with the defined second plane;

5. "***each mask is positioned such that its intersection with the second plane lies within...***": The above intersection is positioned carefully in accordance with the geometrical criteria recited in the claims; and

6. "***each mask is moveable prior to commencing deposition in order to pre-determine the gradient of deposition of each material, but is not moved in the course of the deposition method***": Each mask is positioned prior to commencing deposition in accordance with the desired deposition gradient in each case but is not moved during the deposition process.

With regard to independent claim 5, the Examiner states that Barkley does not teach that a separate mask is used for each different vapor source but contends that this feature is disclosed by Okamoto, and concludes that it would have been obvious to modify Barkley on the basis of Okamoto and to thereby arrive at the present invention.

Applicants do not agree with the Examiner's analysis and stand by all of the arguments already of record. In addition, Applicants have herein amended independent claim 5 to further emphasize the differences between the present invention and the cited references, in an effort to advance the prosecution of this case.

Applicants point out that a first key difference between the present claims, as amended, and the disclosures of Barkley and Okamoto is that the sources used in Barkley and Okamoto are different to those used in the present invention. Barkley teaches the use of point sources, as the Examiner has acknowledged in the last paragraph of page 7 of the Office Action. Similarly, Okamoto teaches elongation of sources, and uses band-like sources, i.e., 1-dimensional sources, as is acknowledged by the Examiner in the last paragraph of page 7 of the Office Action. In contrast to Barkley and Okamoto, the present claims, as amended, require material to be deposited from a face of a source, i.e., the source is 2-dimensional. Applicants assert that <u>the present invention would not work with point or band-like sources</u>. Applicants assert further that there is no disclosure or suggestion in either of Barkley or Okamoto that would lead one of ordinary skill in the art to use a 2-dimensional source as required by the amended claims.

Applicants point out that a second key difference between the present claims and the disclosures of Barkley and Okamoto lies in the nature and positioning of the masks, and the way in which they interrupt the flux of material travelling towards the substrate. According to the present claims, the present invention requires the use of a single edge of a mask to interrupt the flux of material and thus to create the concentration gradient. The edge must be positioned in accordance with the geometric requirements set out in the claims.

Based upon the Examiner's analysis of Barkley on page 6 of the Office Action, Applicants believe that the Examiner has not completely understood the requirements set out in the claims in terms of the positioning of the masks, as opposed to their relevance. In order to assist in this regard, Applicants enclose herewith three (3) sheets of annotated drawings. In these drawings, annotated Figure 1 corresponds to Figure 2 of the present application, but has been annotated to show the first and second planes, and also to show the crossover point "H" and the quadrilateral area $H_2H_1C_2C_1$. This is the area in which the edge of the mask must be according to amended claim 5.

Annotated Figure 2 of the enclosed drawings is similar to annotated Figure 1, but shows the triangular area defined in claim 6. The final figure (annotated Figure 3) is an annotated version of Okamoto's Figure 4, and will be discussed further below.

Beginning with Barkley, the Examiner suggests that "the Figures of Barkley certainly have an E, F, A, C and D as defined". Referring to the enclosed annotated Figures 1 and 2, it can be seen that this is simply not correct -- Barkley uses point sources, so "C" effectively does not exist in the case of Barkley. Thus, crossover point "H" cannot be defined, and nor, therefore, can the area $H_2H_1C_2C_1$.

With regard to Okamoto, Figure 4 of Okamoto shows two sources, two masks and a single substrate. This figure is reproduced in annotated Figure 3 enclosed herewith, wherein the annotations show that the left-hand mask is positioned above crossover point "H", and thus outside of the areas defined in amended independent claim 5 and claim 6. It will be clear that the same applies to the right-hand mask. Thus, Okamoto also fails to meet the geometrical requirements of the present claims.

The Examiner has also asserted that the positioning of the edge of the mask, and especially the geometric requirements set out in the present claims, is a matter of routine experimentation. Applicants point out that there is no basis for the Examiner's assertion. On the contrary, Applicants believe that it is clear from the detailed calculations in the present application that the claimed requirements are the result of detailed analysis and inventive endeavor. Applicants also believe that this is supported by the cited references, both of which also require complex considerations to be borne in mind when positioning the sources, masks and substrates; see Columns 4 and 5 of Barkley; see also the complex arrangement shown for the ternary system shown in Okamoto's Figure 10, where three linear sources and a triangular shielding plate are used.

Applicants point out that a further key difference between the present claims and Barkley and Okamoto lies in the fact that Barkley and Okamoto do not allow the "zooming in" across the full length of the substrate, as described above, to be carried out. In particular, it will be noted that in all cases, Barkley and Okamoto only allow concentration gradients starting from no deposition and ending with a maximum. Thus, Figure 5 of Okamoto shows a linear variation of component concentration <u>from zero</u> to a maximum, across <u>only part of the substrate</u> (d-e). Barkley shows stepped (not linear) variations in component concentration <u>from zero</u> to a maximum, across <u>only part of the substrate</u>. Neither Barkley nor Okamoto allows linear variation from a <u>non-zero</u> starting concentration through to a <u>pre-determined</u>

maximum concentration across the full length of the substrate. This should be contrasted against Table 1 of the present application, which shows that linear gradients with non-zero starting concentrations can be produced across an entire substrate. Thus, Barkley and Okamoto cannot be used as described above to find, and then optimize, the composition of mixtures.

In view of the foregoing, Applicants assert that amended independent claim 5 is allowable. Claim 6 directly depends from amended independent claim 5 and therefore includes all the limitations of that claim. Therefore, Applicants respectfully assert that claim 6 is likewise allowable. Accordingly, Applicants respectfully request that the Examiner withdraw his rejection to amended independent claim 5 and to claim 6 dependent thereon.

**Conclusion**

In view of the foregoing amendments and remarks, Applicants assert that the pending claims are allowable.

Should the Examiner have any question or comment as to the form, content or entry of this Amendment, or if there are any further issues yet to be resolved to advance the prosecution of this application to issue, the Examiner is requested to telephone the undersigned counsel.

Please charge any fees associated with this paper to deposit account No. 50-3355.

Respectfully submitted,

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